EXHIBIT 7

The Information's Leaders and Laggards in Self-Driving Cars

By Amir Efrati   Jun. 12, 2017 7:00 AM PDT

T he race to produce millions of cars that can drive themselves in almost all situations is getting more intense, and more perpl
week. Integrating autonomous vehicles into regular city traffic might be many years away, but even at this early stage, some companies are
further along than others. Indeed, the past year has proven that the race isn't as tight as it looks.

The Information surveyed the entire field—17 major self-driving programs—to determine which will be first to deploy fully autonomous vehicles
at scale in urban cities. We interviewed executives at legacy automakers, Bay Area challengers and startups to develop a detailed ranking of
which companies are leading the field and which are lagging behind. (Scroll down for the list.)

THE TAKEAWAY

**Nobody is close to deploying fully self-driving cars at scale. Silicon Valley, led by Waymo and Uber (yes, Uber), has an edge right now over
the traditional auto industry in the most critical areas, leaving big names like BMW and Audi far behind. Still, the software nerds and car
metal benders ultimately will need to work together before self-driving cars can be integrated into our transportation network.**

While the competition to be the first to deploy self-driving cars is often depicted as a battle between Silicon Valley nerds and old-school Detroit
manufacturers, the truth is that the two sides need each other to get to the finish line. Even Waymo and Uber, the companies who are leading the
race right now, according to our ranking, have a lot to accomplish to master fully autonomous vehicles. Meanwhile, traditional automakers,
despite having capable representatives in the field, lack critical pieces of the puzzle or are late to the game.

One notion that our reporting debunked is that Detroit is ahead of its tech rivals in the pursuit of autonomous vehicles. Some executives leading
these efforts have made bold public statements over the last year that didn't match the reality behind the scenes. (We're looking at you, General
Motors and Ford.) On Tuesday in Mountain View, The Information is speaking to key practitioners at an **event** on the state of play in autonomous
vehicles.

Most of the programs under way won't be commercially ready for a long time, let alone at scale. As The Information columnist **Sam Lessin
points out**, there is no partial credit in self-driving cars; these things have to be nearly perfect before they are truly useful.

"A lot of companies have no road map to get there," said Austin Russell, CEO of Luminar Technologies, a startup that produces lidar sensors for
self-driving cars. "They're relying on other systems to appear" in time, and be available for purchase, he said.

In The Information's ranking, companies vying to transform our cities with robocars that drive themselves under most, but not all, conditions
(otherwise known as "Level 4" autonomy) were evaluated on three equally weighted criteria:

1) **Technology**, or how advanced the company's self-driving system is for urban roads with good infrastructure. This might include public

fusion and mapping.

3) **Business model**, or the ease with which the companies can bring the technology to market at scale.

Companies are scored from 0-5 in each category, with 5 being best. The rankings aim to compare strengths and weaknesses of the programs; a 5 score for Waymo's technology means it is the best among the group, not that it is ready for prime time.

Also, just because one company is higher than another today doesn't mean things will finish that way. Check back for updates.

Failed Google-Ford Link-Up

Business models don't get enough attention in analysis of progress on autonomous vehicles. The ability to test and launch vehicles within a ride-sharing network, or to run a consumer-facing app (Uber's and Waymo's bailiwick, for instance), could be a major advantage. Also lost in the hype is how difficult it is to build a car—no software company can do it without an auto manufacturing partner. If software companies want to come out ahead, they will need to pay to get an automaker to build cars for them.

Waymo, formerly part of Google, is a good example. A partnership with Ford 18 months ago fell apart because Waymo (then still part of Google) didn't want to front some of Ford's cost to expand manufacturing capacity to eventually produce thousands or potentially millions of electric light passenger vehicles that would be powered by Google software, said two people with knowledge of the discussion. Ford doesn't make much money from selling light passenger cars compared with trucks, so mass-producing more of them would have required an investment by Google of tens of millions of dollars, if not hundreds, these people said. Part of the investment would have helped Ford develop electric vehicles, as it was behind its rivals in that regard, one of these people said. There also was discussion about giving the automaker a share of the revenue Google would make from its eventual robotaxi service, a different person said. That might have made it easier for Ford to take on more of the costs for expanding vehicle capacity.

After Ford and Google parted ways, Google's leaders, including co-founder Sergey Brin, agreed to a smaller-scale deal with Fiat Chrysler. It was only for several hundred hybrid vans—now up to 600—and wouldn't require Chrysler to create more manufacturing capacity, these people said. In other words, Waymo still has a big pill to swallow if it wants to get to scale. (Cover your ears, Ruth Porat.)

Most companies are hedging their bets. Some automakers are supplying cars to software companies (Chrysler to Waymo, Volvo to Uber) while also trying to build their own solution. Uber is developing an in-house solution but plans to offer carmakers the chance to put their autonomous cars into Uber's ride-sharing network. (Daimler, the maker of Mercedes-Benz, has raised its hand to do so, even though it is years away from being able to do so.) That means Uber would give up some value or margin but maintain a role in AV efforts even if its own solution fails. Despite a harrowing past few months for Uber's self-driving group and a string of departures, it made a surprisingly strong showing in our ranking, at No. 3, because of its inherent business model advantage and legitimate talent that is still there.

Truly Self-Driving

There is debate about what kind of threshold is necessary to be able to take the driver out of a car. Executives at Waymo, which has driven more miles (three million-plus and counting) than its rivals, won't even say what needs to happen before commercialization begins. But it is worth noting that not all miles are worth the same; figuring how often and what type of potentially dicey situations can occur around the cars is one of the main goals of test drives. When it comes to technical requirements for self-driving systems, philosophical differences abound in areas such as mapping, where and how to use deep-learning algorithms, what kind of simulation software can help train decision-making drive algorithms in order to supplement the real-world training, and how many sensors are enough.

Another important consideration is that these companies aren't pursuing the same ends. Some automakers don't define what limitations their autonomous systems will have when they are available to the public. Even in the short term, there are different goals. NuTonomy (no. 6 on the list), the self-driving software startup that has gotten the most attention in the industry so far, is aiming at speeds of 35 mph or slower. Tesla aims to expand from autonomous driving on highways to more complex city streets—in essence, a comprehensive solution. Waymo, at least at

auto brands—so its path may be simpler.

Then there is a question of outsourcing. Automakers that rely heavily on software providers like Mobileye, which sells a chip to process camera imagery and image-recognition software to pick out objects in view, get dinged in the ranking. (Sorry, BMW and Audi.) That's because Mobileye's job is to sell its technology to as many customers as possible, so no single customer would be advantaged. And for carmakers, relying on Mobileye has a downside because Mobileye can **retain key data** generated by cameras on the car that it can use to continually improve its own algorithms.

Fast-Evolving Technology

The ranking doesn't take into account semi-autonomous features. They will be available sooner and potentially save lives, but they won't change the way most people get around. Nor does this survey address two communications technologies being developed to allow cars to coordinate with, or "speak to" other cars, or to interact with road infrastructure such as traffic lights. Those advancements, in theory, would benefit all the players somewhat equally.

Many variables could affect the companies' progress. Will carmakers get better at wirelessly collecting camera data from their newer cars, helping them to catch up to data-rich competitors like Waymo? Will lidar performance improve and make solving the driving problem easier than practitioners first thought, and will automotive-grade lidar be cheap and widely available? Will the best car security software be proprietary and considered a competitive advantage? Will competent self-driving software be available for sale to any company, or will there be no equivalent to Android in the car world, just a bunch of Apple wannabes owning both hardware and software?

The stakes of this race are particularly high for traditional automakers because the number of cars sold in developed markets will almost surely drop, thanks to ride-sharing networks and self-driving technology. The bigger the auto company, the bigger the risk. Even if automakers can figure out autonomy, it isn't in their DNA to run a ride-sharing business and deal directly with customers.

To that end, almost all the automakers in our analysis have taken equity stakes in, acquired, or set up their own services such as car-sharing (GM has Maven, BMW has DriveNow, Daimler has Car2Go) or ride services (Ford bought Chariot, GM has a substantial stake in Lyft, Volkswagen has a substantial stake in Gett).

Some well-known auto brands like Honda, Groupe PSA (Peugeot) and Hyundai didn't make the cut because they don't appear to have a serious effort to develop a fully autonomous vehicle in-house. Also excluded are startups that lack a path to get to market at scale: Aurora Innovation (led by Chris Urmson, former chief of Google's self-driving car project), Nuro, Optimus Ride and Drive.ai. They might be good acquisition targets. Other well-funded car startups such as Zoox and Nio are attempting to do for self-driving cars what Apple did for phones, developing the hardware and software from the ground up.

One of the loudest voices in this nascent industry, Nvidia, is a chipmaker that has promised to help develop a fully autonomous "AI car" with several manufacturers by next year. Veterans of the self-driving car industry aren't holding their breath. For all its bluster, or perhaps because of it, Nvidia isn't included in our ranking, though it might end up selling a lot of computing chips to companies that are.

The Race to Build Self-Driving Cars

Source: The Information
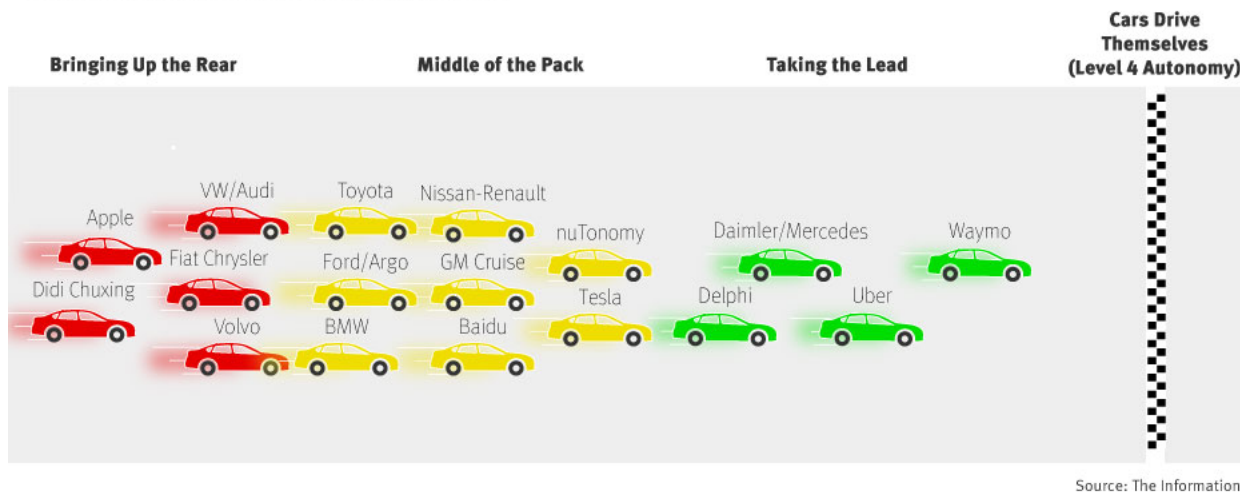
Rankings

1. Waymo

Technology: **5**
Engineering: **4.5**
Business Model: **3.5**

Score: 13 / 15

Almost everyone watching the industry, including Waymo's rivals, view the newly formed division within Alphabet as the one to beat. It wasn't so long ago that Waymo, previously part of Google, **seemed in jeopardy** of losing its first-mover advantage in car software because it "incited others to chase the same value proposition," as a former Google car developer put it.

A lot has changed in a year. It became clear how many holes some big automakers had in their autonomous software plans. That made Waymo look better by comparison. Rivals also have taken note of Waymo's self-proclaimed strength in hardware: It developed its own lidar sensor, which detects images by emitting laser lights, that purportedly performs better than other lidars available for cars today.

While it has lost some key people during this span (an older list is **here**) it retained others with strong reputations and nearly a decade or more of experience in the field. That means they know what technical approaches *don't* work in ways most of its rivals do not. Some key names on the engineering team led by Dmitri Dolgov are: Pierre-Yves Droz (lidar); Nathaniel Fairfield (motion planning); Andrew Chatham (software infrastructure for data, HD maps); and software engineer Mike Montemerlo, who helped lead the Stanford University team that won a DARPA "Grand Challenge" competition for autonomous cars in 2005—four years before Google's self-driving program began.

The company said it is testing an autonomous ride-sharing service in the Phoenix area, though it isn't clear when there will be a broader commercial launch and how limited the service will be in terms of geography. While Waymo has been talking to Lyft about operating the ride-sharing service's cars for a long time, it's tough to make much of it at the moment. After all, Lyft wants to work with everybody in the autonomous field because it lacks the resources to pursue its own program. Waymo is very much able and willing to go it alone with a robotaxi service if it needed to.

The big remaining question is Waymo's ability to nail a long-term deal with a carmaker. If not Fiat, then perhaps Honda, which has publicly said it was interested. After Waymo validates its self-driving system, it could start thinking about licensing it to other automakers, something its leaders have discussed.

Related: **Google Scaled Back Self-Driving Car Ambitions**

Technology: **2.5**

Engineering: **3.5**

Business Model: **4**

Score: 10 / 15

[Update: Uber's self-driving car unit has lost points for its lack of progress and the negative impact of recent events, which led the company to consider ways to defray research and development costs.]

The disgraced former chief of Uber's autonomous vehicle program, Anthony Levandowski, and Uber CEO Travis Kalanick have repeatedly told colleagues that autonomous vehicles are a winner-take-all market and fear Waymo might eat Uber's lunch if Waymo is too far ahead. (Internally, instead of saying the words "Google" or "Waymo," Mr. Levandowski used a code term: "state of the art.") Last year, Mr. Levandowski privately said to at least one colleague that his team was five years behind Waymo's but had a chance to gain on its chief rival. Leaked data about Uber's test drives underscores the **relative nascency** of Uber's technology.

Yet Uber has advantages versus Waymo in terms of business model: First, Uber has an existing transportation service that it plans to slot autonomous vehicles into as they become ready, while Waymo will have to work with an external partner (like Lyft) to do so. Because Waymo's own ride-sharing service would need to roll out slowly, city by city, Uber should have time to catch up. In the meantime, it could potentially lower fares significantly in order to prevent Waymo from grabbing market share in those places where it does operate, other than from novelty-seeking riders. Waymo's system won't be able to go everywhere like Uber's human drivers can, so practicality should trump novelty.

Second, Uber is an operations-led company that knows how to run businesses in cities around the world, and that expertise could be deployed to manage the eventual autonomous vehicles in Uber's fleet.

Third is Uber's deal with Volvo for thousands of vehicles, not just hundreds as in the case of Waymo-Chrysler, according to a person at Uber.

On talent, just like Waymo, Uber has lost some good people in recent months. But it has retained plenty, too: In Pittsburgh, Carnegie Mellon University alums David Stager (systems engineering), Dan Tascione (software infrastructure); and Jeff Schneider (machine learning); and in San Francisco, Andrew Gray (perception), formerly of Tesla and Cruise. One rival that has been trying to hire from Uber griped to The Information that Uber has been paying people twice the market rate—sometimes $1 million a year—in order to keep them from departing amid the daily Uber scandals and Waymo's blistering trade-secrets theft lawsuit against Uber.

The legal wranglings drove out Mr. Levandowski, who now faces a criminal inquiry. One other alleged wrongdoer that Uber poached from Google/Waymo resigned from Uber before the suit was even filed, after Google had initiated separate legal proceedings against some former employees.

Related: **For Uber, Waymo Lawsuit Brings New Risks**

3. Daimler

Technology: **3**

Engineering: **3.5**

Business Model: **3.5**

Score: 10 / 15

Of the major German car brands, Daimler has one of the best track records in developing semi-autonomous driving features. Expectations about its future performance in the autonomous field are based almost entirely on that reputation, even though the company hasn't revealed much about its fully autonomous car plans besides setting a goal of launching something "early in the next decade."

In January, Daimler took an odd turn by announcing it would develop an "AI car" with chipmaker Nvidia that presumably would attempt to use

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and assume Daimler only agreed to make the announcement in order to score a better deal on its purchase of microchips from Nvidia, which it could use for its existing autonomous program.

Because Daimler sells a smaller volume of cars than other automakers on this list, and its vehicles are purchased by affluent individuals, there is a chance it could potentially sell a fair number of automobiles through the traditional dealer model. The customers might decide they would rather own expensive self-driving cars than share cars with the hoi polloi via ride-sharing networks. Daimler isn't giving an exact timeline for when it will release fully autonomous cars, other than saying it would be at least three years and that it would presumably run robotaxi services. Through Car2Go, a car-sharing subsidiary, Daimler already operates a fleet of thousands of vehicles in 30 cities in North America, Europe and China. That could come in handy.

Related: **CES Proves Automakers Confused About Autonomous**

3. Delphi

Technology: **3**
Engineering: **3**
Business Model: **4**

Score: 10 / 15

Like Daimler, Delphi also may be overrated. But it is the auto supplier that autonomous vehicle practitioners take most seriously. That is partly because of its 2015 acquisition of Ottomatika, a spinoff from Carnegie Mellon University (a hotbed of self-driving car and robotics research), which included an engineering team and software to power a self-driving system. Under the direction of Delphi CTO Glen De Vos, much of that core team from Ottomatika is still at Delphi, having cost the company $30 million over three years—cheap in 2017 self-driving car talent dollars!

Unlike with carmakers that are partnering with Mobileye, Delphi's rating on this list doesn't drop for working with the Israeli chipmaker, which is being acquired by Intel. That's because Delphi's business model is different; it is working on products that it could sell to multiple automakers that don't already have their own in-house programs or end up struggling.

Delphi has been faster than most in getting autonomous vehicles out in front of the public for competent test rides. A former auto parts arm of General Motors, Delphi last week announced it would operate two autonomous vehicles to carry passengers in Normandy, France, in addition to its plans to do so in Singapore and a still unnamed U.S. city. It is doing so to help train its self-driving system that it plans to sell to automakers by 2019, meaning it would theoretically be available to end-customers at scale by 2021.

6. Tesla

Technology: **3.5**
Engineering: **2.5**
Business Model: **3**

Score: 9 / 15

Betting on Tesla to win this race means betting against the vast majority of people in the field who insist that lidars are necessary for full autonomous driving. CEO Elon Musk has famously cut across the grain to say Tesla believed the sensors were extraneous and expensive, and that cameras and radars alone should do the trick. "If we're wrong about that, that's a big mistake," said a person with knowledge of Tesla's strategy. It's also possible that lidars will come down in price and go up in quality enough over time that Musk will reconsider. For now, even lidars made by market leader Velodyne aren't yet strong enough for commercial vehicles, or "automotive grade," and there is a huge backlog of orders.

The person who has knowledge of Tesla's worldview on self-driving cars put it this way: Solving autonomous driving problems is made easier by

fleet run by Tesla. (That would require a shift in Tesla's core competency, but not as much as for other automakers, which don't push software updates to their cars every week like Tesla does.) Tesla also has the ability to manufacture and distribute cars in multiple countries and to service them, too.

Retention of talent has been an issue over the past year, with several key people from Tesla's self-driving unit departing to Nvidia, Audi, Uber and Aurora. *[Update, June 20, 2017: Tesla lost another leader of its Autopilot program, Chris Lattner, underscoring its talent challenge (which means losing half a point in our scoring)—and probably reflecting the difficulty of hitting Mr. Musk's audacious deadlines.]*

But if developing autonomous vehicles is partly a race to see who can collect as much driving data as possible in order to train algorithms to understand various scenarios a driver might encounter and make the right decisions, Tesla is a sleeping giant. Because its cars have cameras and because those cars are connected to the internet, Tesla vacuums up not just imagery from when the car is in autopilot mode for semi-autonomous driving on highways, but from city driving, too, though it tries to make sure never to gather data that identifies owners or where they live, this person said.

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Tesla used Mobileye for identifying objects via camera until last year, when the companies parted ways. That split degraded the quality of autopilot mode. A year later, Tesla believes it is "close to at par" with the obstacle detection it had using Mobileye previously, said the person familiar with its strategy. Perhaps that's why Mr. Musk said it would be two years before his customers could close their eyes once inside a Tesla car and wake up at their destination. That might just be good salesmanship on his part.

Related: **Key Sensor for Self-Driving Cars in Short Supply**

6. nuTonomy

Technology: **3**
Engineering: **3**
Business Model: **3**

Score: 9 / 15

This is the most high-profile independent startup in the industry right now, with more than 100 employees. NuTonomy has about a dozen autonomous cars being tested on roads in Singapore and Boston, and they have driven thousands of kilometers. NuTonomy says it will have a commercial robotaxi service there by next year. CEO Karl Iagnemma touts his cars' ability to handle complex situations including passing with incoming traffic, occluded intersections, driving near pedestrians, tough parking spots, construction zones and driving in the rain.

NuTonomy, a name that comes from combining "new" and "autonomy," was founded by two faculty members at the Massachusetts Institute of Technology, including an early researcher of "rapidly exploring random tree" algorithms. Mr. Iagnemma said those algorithms come in handy when an autonomous car needs to plan its path. Groupe PSA, the owner of Peugeot, is taking a chance on that by integrating nuTonomy's software with a few of its vehicles. If it goes well, the collaboration could mushroom into a large fleet.

NuTonomy has developed so-called fleet management software and plans to deploy its vehicles within existing ride-sharing networks like that of Grab (Singapore) and Lyft in the U.S.—an agreement nuTonomy announced last week. People in the industry say nuTonomy is currently raising a funding round after having raised $20 million so far.

7. Baidu

Technology: **2**
Engineering: **3**
Business Model: **3.5**

Score: 8.5 / 15

Baidu, the Google of China, might be overrated on this list. The leader of its autonomous vehicle program, Jing Wang, quit recently. That

Baidu's plan in July to open source some of its self-driving software, so that other developers could use it and improve upon it, means it probably isn't very good. And **problems in Baidu's core business** mean it may have less ability to put resources behind the car program.

Still, Baidu is one of the only real autonomous programs in China and has relationships with many Chinese automakers. There is no doubt it will have an edge when it comes to commissioning and rolling out cars there. It's hard to imagine a foreign program figuring out that market. That's why it is worth keeping an eye on Mr. Wang, who is launching a self-driving startup of his own.

Related: **How Baidu is Leading China's Self-Driving Push**

8. GM/Cruise

Technology: **2.5**
Engineering: **2.5**
Business Model: **3**

Score: 8 / 15

General Motors buying Cruise for $581 million in early 2016 seemed like a great way to put itself on the map in autonomous cars while gaining software talent it might otherwise have trouble hiring. Today, it appears that GM made its big bet too early. New teams of engineers with a lot more experience in autonomous research than those at Cruise have launched startups over the past year or so.

Cruise is ahead of its Detroit rivals, for now. Its autonomous cars have driven more than 10,000 miles on the complex streets of San Francisco. But those cars don't seem to be as good at driving themselves as Cruise says they are, in terms of how often they make mistakes. Still, GM leadership has put its faith in Cruise CEO Kyle Vogt. They recently gave him more responsibility around how to commercialize autonomous vehicles. The company has said it will launch a small-scale robotaxi trial by the end of this year. (By now, it was already supposed to have launched a robotaxi service through Lyft, in which GM has a financial stake, so that's taking longer than expected.)

GM's shareholders might not be willing to stomach another large acquisition, but they may also have no choice.

Related: **Cruise's Self Driving Cars May not be as Smart as they Appear**

8. Nissan-Renault

Technology: **2.5**
Engineering: **2.5**
Business Model: **3**

Score: 8 / 15

Thanks to its charismatic CEO, Carlos Ghosn, Nissan was one of the earliest automakers to promise self-driving cars by a certain date—2020 in its case. It has driven thousands of test miles with prototype autonomous cars on public roads in California, plus additional mileage in Japan and the U.K. That's more experience than some other automakers.

While it is unclear whether the company's technical team has the right chops to get to the finish line, they have at least considered how to fix mistakes that its autonomous cars might experience on the road, in real time. A remote assistance feature it is developing allows a human operator in a central location to send instructions to a car on how to maneuver past a construction zone that it doesn't know how to handle, for instance. The downside is that it is hard to see how that kind of system scales to help thousands of riders at a time.

10. Toyota

Technology: **1.5**

Score: 7.5 / 15

The Japanese company's top executives famously under-appreciated autonomous technologies until just a couple of years ago, much later than some of its fellow automakers. At the start of 2016 it formed the U.S.-based Toyota Research Institute, with a budget of $200 million a year, to figure out autonomous vehicles. In January, Gill Pratt, who leads the research institute, tempered expectations around fully autonomous cars, saying they were much further away from reality than the industry has claimed.

On the other hand, according to one rival auto executive, when it came to hybrid technology, Toyota publicly under-promised but ended up over-delivering. Given its track record and the pedigree of some of its roboticists, including Mr. Pratt and former Googler James Kuffner, it would be a mistake to count out the world's top car seller. For now, Mr. Pratt said the company is working on expanding on technology such as automatic emergency braking, which is already standard in most new Toyota cars, to act as an always-on "guardian" for drivers, ready to step in to help them avoid accidents.

10. Ford/Argo

Technology: **2**
Engineering: **2.5**
Business Model: **3**

Score: 7.5 / 15

Based on Ford's confident public comments last year about its self-driving car team and plans, it seemed like the company had it all figured out. Not true, as evidenced by Ford's blockbuster acqui-hire in February of several experienced self-driving car engineers from Waymo and Uber. The engineers called themselves Argo AI, and that group is now responsible for what Ford calls the "virtual driver," or the driving software, for its autonomous cars, which are scheduled to be sold in 2021. Given the Argo infusion, Ford has a better chance to rise up in these rankings than it did six months ago, though profit concerns about its core business led the ouster of its CEO, Mark Field, a few weeks ago.

Unlike with Cruise at GM, Argo is uniquely structured to be able to maintain some independence from Ford, and to hire real talent from the outside. Argo is a subsidiary from an accounting point of view, and Ford has a majority stake. But Ford, which is giving Argo a budget of $200 million per year for five years, doesn't have outright control of Argo's board of directors. (Two directors are from the original Argo team; two are from Ford; and one is independent.) Argo's structure allows it to reject certain business demands by Ford, and it can raise outside capital, too, if it wants, or partner with other tech companies or automakers. The current structure could allow Argo to be spun out as a public company someday. Right now, Argo can hand out more than 10% of its equity to employees as part of their compensation. It currently has about 100 employees.

12. BMW

Technology: **1.5**
Engineering: **2.5**
Business Model: **3**

Score: 7 / 15

Partnership announcements are supposed to have a positive effect. With BMW, most announcements about autonomous technologies inspire more skepticism. The company keeps talking up its desire to create a consortium of companies that will ostensibly collaborate on a self-driving "platform." It says any company is welcome to join, but there is no indication about how any collaboration would work. BMW's key partner in the group is Mobileye, meaning BMW is being honest about how it is outsourcing a key part of its technology. At CES earlier this year, the best BMW could do in terms of a demo for reporters was to show its adaptive cruise control for highway driving.

13. VW/Audi

Business Model: **3**

Score: **6.5 / 15**

Here's why the Audi self-driving program isn't top of mind in the industry: On its website, Audi touts its January announcement with Nvidia—that they would use AI to build a fully autonomous car by 2020—as its main autonomous vehicle accomplishment of 2017. Few in the field think Nvidia can actually develop self-driving car software. Audi also is relying heavily on chipmaker Mobileye for a key part of the self-driving software stack.

It wasn't until March that Audi created a dedicated unit focused on autonomous driving and commercializing it. Audi hired a key manager from Tesla's autopilot group to be the new unit's CTO.

14. Volvo/Autoliv

Technology: **1.5**
Engineering: **1.5**
Business Model: **3**

Score: **6 / 15**

In April, Volvo and auto parts supplier Autoliv started operating a joint venture to develop a self-driving car. That suggests Volvo didn't have much on its own, and perhaps why it wants to sell thousands of cars to Uber to aid that company's self-driving car program.

15. Fiat Chrysler

Technology: **1.5**
Engineering: **2**
Business Model: **2**

Score: **5.5 / 15**

The company's main play in autonomous vehicles right now is supplying electric minivans to Waymo, so it almost didn't make it into this list. But it has been testing its own prototype autonomous vehicle on Michigan roads and has hired some well-known external talent to boost the program. One thing is clear: Fiat Chrysler expects to be able to purchase self-driving hardware and software from other suppliers and thus focus mainly on how the autonomous driving feels to the rider. In other words, if autonomous vehicle software doesn't become commoditized, Fiat Chrysler won't have many options. It also doesn't have the resources to work on consumer-facing services to commercialize self-driving cars.

Related: **Fiat's Secret Self Driving Car Shows How Industry May Evolve**

15. Apple

Technology: **1.5**
Engineering: **3**
Business Model: **1**

Score: **5.5 / 15**

Apple is far behind in this race. Its effort to build a self-driving car, dubbed "Project Titan," has been the subject of constant speculation for the better part of two years. Apple has hired hundreds of people for its program, and cut some staff last year, but little is known beyond that. The program also had a leadership change last year and only this year got a permit to test its software on California roads. But Apple said it would test vehicles with senior engineers on the project, which is a sign that it is far from ready to have autonomous vehicle "trainers," who are

15. Didi Chuxing

Technology: **0**

Engineering: **0.5**

Business Model: **4.5**

Score: 5 / 15

The Uber of China has a relatively new program and is hiring. It did hire Charlie Miller, a noted security engineer, from Uber's self-driving program, and at least one engineer from Waymo who specialized in object detection. Didi has some of the same potential advantages as Uber in terms of the ability to test, deploy and manage cars, not to mention making money from them via its core ride-sharing business.

This article has been updated with another detail about the Google-Ford talks.

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Jamie Quint
Lead Product Manager, Monetization and Growth, Reddit

2 months ago

This list feels completely made up. It seems disingenuous to list Daimler/Tesla/Baidu, companies who haven't (AFAIK) even shown a video of true city self-driving (taking into account pedestrians, bikes, stop signs, stop lights, etc), as ahead on technology of companies like GM/Cruise who have. Many of these companies' self driving "city" videos are wide suburban roads that emulate highways.

Additionally, as a tech publication it seems silly to discount startups as non-viable because they have "no path to market". I guarantee you that if someone came up with 10x better self-driving tech they wouldn't have any trouble getting to market.

Like

Amir Efrati
Senior Reporter, The Information · Article author

2 months ago

Thanks Jamie. A few thoughts. On startups, we have little information on those I listed so it's impossible to include them in a list of bigger programs. We have to draw the line somewhere and will add them when we get more information. (At least they got mentioned!)

On the other matters. As you know from reading The Information, a video of a car navigating through a city is only a partial indicator of real technology. (See our article on Cruise.) Tesla has its own way of doing marketing, and we have appropriate caveats about the risks there, but also there data advantage, which is real. On Baidu, because it is on a different playing field than GM, it is fair to suggest that it has a more sure path to success right now.

On Daimler, they may indeed be overrated. This ranking is largely based on reporting and the consensus of people who have worked on self driving car technology for the better part of a decade. They all take Daimler seriously. Appreciate your feedback!!

Like · Jamie Quint and Hendrik Laubscher liked this.

Jamie Quint
Lead Product Manager, Monetization and Growth, Reddit

2 months ago

significantly higher signal than quantitative data on takeovers. DMV data could easily say more about a given company's willingness to test code on the roads, or a given company's propensity to test on highways or suburban roads (as Waymo/Google did a lot of, at least historically) vs. cities (where all of GM/Cruise's self-driving occurs).

Like

Raghu Gullapalli
Venture Partner, Cascade Global

2 months ago

I think the debate over systems - Tesla's camera/sensor system or Lidar, is akin to the question of VCR or Betamax. While Betamax was recognized as superior, it failed to achieve product market fit and VCR became the industry standard. Similarly while Tesla's system may be marginally inferior, at the current time it is far more aesthetically pleasing than the unicorn horn that make up the Lidar system in it current iteration. And the point regarding data is particularly valid as Tesla has accumulated hundreds of millions of miles of data if not billions in contrast to the Lidar data that is fragmented among many players all of whom have yet to deploy a system commercially and thus have far less data to appeal to regulators with, much less consumers.

Like · Amir Efrati liked this.

Stowe Boyd

2 months ago

typo: '(an older list is here' lacks closing paren.

Like · Amir Efrati liked this.

Amir Efrati
Senior Reporter, The Information · Article author

2 months ago

@Jamie – It's not cheating. It's about selective disclosure. Anyone can "nail" a recorded demo. That only tells you 1% of the story.
https://www.theinformation.com/cruises-self-driving-cars-may-not-be-as-smart-as-they-appear

Like

Aarjav Trivedi
Founder & CEO, RideCell

2 months ago

@Amir - Glad to see business model as a key KPI being measured. Companies with an operating mobility business have a huge advatnage over those who are doing just R&D. If you have one self-driving car and an app, it may feel like you have recreated Uber, but managing a service with even hundreds of cars in multiple cities is a whole another level of complexity.

More importantly, there's a significant and hidden "skill" gap even amongst ridesharing leaders around managing an actual fleet of tens of thousands of vehicles per city. As a thought exercise, imagine you could wave a magic wand and all of Uber's cars would turn autonomous overnight. How would their impact their business? Most people think it would be a huge boost to the business overnight. Actually, their business would actually get significantly harder because owners (nee drivers), who currently clean, maintain, insure (partially) and take care of 100 edge case issues around cars would suddenly want Uber to take care of those problems. More importantly, where they are happy to get 4-6 hours of "revenue time" today on average per day, they would want their asset to be utilized as much as possible, increasing utilization expectations. These are hard problems that Uber and other ridesharing "incumbents" are just beginning to dip their toes into.

Another note: with BMW, I don't see a mention of ReachNow - BMW's ecosystem of mobility services in the US which includes one-way carsharing

differentiated service. They also run DriveNow—the second largest one way carsharing services after Car2go in 8 countries.

On a much smaller scale, VW just started running a carsharing service called Omni in Europe.

Full disclosure: BMW, VW and Google are customers, and pretty much everyone else on this list is a prospect we have had interactions/relationships with.

Like · Eric X, Amir Efrati and **1 other** liked this.

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